MID-IR SUB-DOPPLER ERESOLUTION SPECTROMETER USING AN ENHANCED-CAVITY ABSORPTION CELL COUPLED WITH A WIDE BEAM

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We have introduced a wide-beam-coupled enhanced-cavity absorption cell (ECAC) into a 3-μm difference-frequency generation spectrometer in order to reduce transit-time broadening of Lamb dips. It contains concave and convex mirrors with a curvature radius of $\pm$7 m separated by 37.5 cm, has a finesse of 770, and is coupled with a Gaussian beam having a $1/e^2$ radius of 1.9 mm at beam waist. The spectrometer is applied to record sub-Doppler resolution spectra of the ν_3 band of CH_4 and the ν_1 and ν_4 bands of CH_3D, and the transit-time broadening is estimated 30 kHz for these molecules. The observed Lamb dips are about 80 kHz (HWHM) wide, which is one third of those recorded using another ECAC coupled with a $1/e^2$ radius of 0.7 mm at the beam waist. Some A_1-A_2 splittings of the low J levels for CH_3D are first resolved, and the absolute transition frequencies are determined with a relative uncertainty of 10^{-9}.

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